Algebra V (2) Factorising Quadratics with double brackets

Do now:

PUT INTO BRACKETS

Factorise these completely.

1 $5x^3 + 15x^4$

$5x^3(1 + 3x)$

2 $27a^4 + 9a^2$

$= 9a^2(3a^2 + 1)$

3 $3x^3 - 18x^2$

$= 3x^2(x - 6)$

4 $24p^4 - 6p^5$

$= 6p^4(4 - p)$

5 $9x^3y^2 - 12x^2y^4$

$= 3x^2y^2(3x - 4y^2)$

6 $8xy^3 - 24x^3y$

$= 4xy(2y^2 - 6x^2)$

$= 8xy(y^2 - 3x^2)$

Extension

25 $(x - y)^2 - (x - y)^3$

$(x - y^2) - (x - y)^2(x - y)$

$= (1 - x + y)(x - y)^2$

26 $x(x + 1)(x + 3)(x + 5) - x(x + 3)(x + 5)$

$(x + 1 - 1)[x(x + 3)(x + 5)]$

$= x[x(x + 3)(x + 5)]$

$= x^2(x + 3)(x + 5)$

Can you spot a pattern.....

SUM PRODUCT

$a^2 + 5a + 6$

$(a + 2)(a + 3)$

$a^2 + 2a + 3a + 6$

$a^2 + 5a + 6$

$t^2 + 7t + 10$

$(t + 5)(t + 2)$

$t^2 + 5t + 2t + 10$

$t^2 + 7t + 10$

$m^2 - 5m + 6$

$(m - 2)(m - 3)$

$m^2 - 2m - 3m + 6$

$m^2 - 5m + 6$

$y^2 + 25y + 100$

$(y + 20)(y + 5)$

$y^2 + 20y + 5y + 100$

$y^2 + 25y + 100$

$x^2 + x - 6$

$(x - 2)(x + 3)$

$x^2 - 4x + 4$

$(x - 2)^2$

Worked Example	Your Turn
$x^2 - 10x + 21 =$ (SUM, PRODUCT) $= (x-7)(x-3)$	$x^2 + 10x + 21 =$ (SUM, PRODUCT) $= (x+3)(x+7)$
$x^2 + 14x + 24 =$ (SUM, PRODUCT) $= (x+12)(x+2)$	$x^2 - 2x - 24 =$ (SUM, PRODUCT) $= (x-6)(x+4)$

9 $x^2 + 1x - 56$

$(x+8)(x-7)$

10 $x^2 + 32x + 60$

$(x+30)(x+2)$

11 $x^2 - 6x - 27$

$(x-9)(x+3)$

12 $x^2 + 16x - 80$

$(x+20)(x-4)$

13 $x^2 + 14x + 13$

$(x+1)(x+13)$

14 $x^2 + 12x - 28$

$(x+14)(x-2)$

15 $x^2 + 2x - 80$

$(x+10)(x-8)$

16 $x^2 - 11x + 30$

$(x-6)(x-5)$

17 $x^2 + 8x - 48$

$(x + 12)(x - 4)$

18 $x^2 + 18x + 72$

$(x + 6)(x + 12)$

19 $x^2 + 17x + 52$

$(x + 13)(x + 4)$

20 $x^2 - 12x - 28$

$(x - 14)(x + 2)$

21 $x^2 + 11x + 24$

$(x + 3)(x + 8)$

22 $x^2 - 11x - 42$

$(x - 14)(x + 3)$

23 $x^2 - 18x + 32$

$(x - 16)(x - 2)$

24 $x^2 - 7x - 60$

$(x - 12)(x + 5)$

Factorise $6 + x^2 - 5x$

This needs to be rearranged into the familiar form, i.e. x^2 term first, then the x term and finally the number.

$6 + x^2 - 5x = x^2 - 5x + 6$

$= (x - 2)(x - 3)$

Possible pairs:
1, 6, sum 7, reject
2, 3, sum 5, correct.

25 $8 + x^2 + 9x = x^2 + 9x + 8$

$(x + 8)(x + 1)$

26 $9 + x^2 - 6x = x^2 - 6x + 9$

$(x - 3)(x - 3) = (x - 3)^2$

27 $11x + 28 + x^2 = x^2 + 11x + 28$

$(x + 4)(x + 7)$

29 $9 + x^2 + 6x$

$(x + 3)^2$

30 $8 + x^2 - 9x$

$(x - 8)(x - 1)$

31 $17x + 30 + x^2$

$(x - 15)(x - 2)$

Factorise $x^2 + 6x + 9$

If you cannot see the numbers required, write down all the pairs whose product is 9.

$x^2 + 6x + 9 = (x + 3)(x + 3)$
$= (x + 3)^2$

3×3 or 1×9

Factorise

41 $x^2 + 10x + 25$ $(x+5)^2$

42 $x^2 - 10x + 25$ $(x-5)^2$

43 $x^2 + 4x + 4$ $(x+2)^2$

45 $x^2 + 12x + 36$ $(x+6)^2$

46 $x^2 - 12x + 36$ $(x-6)^2$

47 $x^2 - 4x + 4$ $(x-2)^2$

Factorise $6 - 5x - x^2$

When the x^2 term is negative, the terms should be arranged: number term, then the x term and finally the x^2 term. This means that the x term appears at the end of each bracket.

$6 - 5x - x^2 = (6 + x)(1 - x)$

2×3 or 6×1

Factorise

1 $2 - x - x^2$

2 $6 + x - x^2$

3 $4 - 3x - x^2$

4 $8 + 2x - x^2$

5 $6 - x - x^2$

6 $2 + x - x^2$

7 $8 - 2x - x^2$

8 $5 - 4x - x^2$

Factorise $6 - 5x - x^2$

When the x^2 term is negative, the terms should be arranged: number term, then the x term and finally the x^2 term. This means that the x term appears at the end of each bracket.

$6 - 5x - x^2 = (6 + x)(1 - x)$

2×3 or 6×1

Factorise

1 $2 - x - x^2$

2 $6 + x - x^2$

3 $4 - 3x - x^2$

4 $8 + 2x - x^2$

5 $6 - x - x^2$

6 $2 + x - x^2$

7 $8 - 2x - x^2$

8 $5 - 4x - x^2$

1. $2 - x - x^2 = -1(x^2 + x - 2)$

$= -1(x + 2)(x - 1)$

$= (1 - x)(x + 2)$ or $(-2 - x)(x - 1)$

2. $6 + x - x^2 = -(x^2 - x - 6)$

$= -(x - 3)(x + 2)$

$= (3 - x)(x + 2)$

3. $4 - 3x - x^2 = -(x^2 + 3x - 4)$

$= -(x + 4)(x - 1)$

$= (1 - x)(x + 4)$

4. $8 + 2x - x^2 = -(x^2 - 2x - 8)$

$= -(x - 4)(x + 2) = (4 - x)(x + 2)$

Factorise $6 - 5x - x^2$

When the x^2 term is negative, the terms should be arranged: number term, then the x term and finally the x^2 term. This means that the x term appears at the end of each bracket.

$6 - 5x - x^2 = (6 + x)(1 - x)$

2×3 or 6×1

Factorise

1 $2 - x - x^2$

2 $6 + x - x^2$

3 $4 - 3x - x^2$

4 $8 + 2x - x^2$

5 $6 - x - x^2$

6 $2 + x - x^2$

7 $8 - 2x - x^2$

8 $5 - 4x - x^2$

5. $6 - x - x^2 = -(x^2 + x - 6)$

$= -(x + 3)(x - 2)$

$= (2 - x)(x + 3)$

6. $2 + x - x^2 = -(x^2 - x - 2)$

$= -(x - 2)(x + 1)$

$= (2 - x)(x + 1)$

7. $8 - 2x - x^2 = -(x^2 + 2x - 8)$

$= -(x + 4)(x - 2)$

$= (2 - x)(x + 4)$

8. $5 - 4x - x^2$

$= -(x^2 + 4x - 5)$

$= -(x + 5)(x - 1)$

$= (1 - x)(x + 5)$